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ABSTRACT

The universities and institutions that deal with undergraduate education generally have a traditional organizational structure: their human resources are allocated to departments which are structured on subjects, and the persons are grouped according to their specialization profile. As a result of this, it has been observed that many groups are disconnected from the university purposes in education, research, and services due to their high level of specialization. This paper shows a model adopted by the Automation and Systems Laboratory--LAS--of the Catholic Pontifical University of Parana, PUC/PR, based in an organizational cell called Laboratory, which comprises rooms and equipment for its administration, teaching and research activities and services facilities, and assigned faculties and technicians. The Laboratory has its goals and people with different qualifications and skills work to match them. Research goals are the main link in Laboratory activities. Another aspect is the knowledge transfer to the education and service projects like continuous training, undergraduate, and graduate programs offered by the Laboratory and the university. It is shown how this type of organizational cell works, integrated with the community and the university, assuring the perfect implementation of basic university purposes. (SAH)

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The Laboratory as an Organizational Cell - The Case of Automation and Systems Laboratory of PUC-PR

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Abstract *- The universities and the institutions that deal with undergraduate education generally have a traditional organizational structure: their human resources are allocated in departments, which are structured on subjects, and the persons are grouped according to their specialization profile. As a result of this, it has been observed that many groups are disconnected from the university purposes in education, research and services, due to their high level of specialization.*

Nowadays, the needs for continuous qualification require well-prepared human resources from the universities as an answer to the great transformation of the contemporary technological society , which demands for personnel with fast answer abilities.

In this new social-economics reality guided by high competitivity, by a demand for highly qualified products and services and by the technological changes, the real function of the educational institutions are changing to a new concept of education: the continuous education. This system has new features like class attendance or distance learning and short duration programs. This scenery also conducts the university to become a special agent in the Technological Innovation Process.

This paper shows a model adopted by the Automation and Systems Laboratory - LAS - of the Catholic Pontifical University of Parana - PUC/PR, based in an organizational cell called Laboratory, which comprises rooms and equipment for its administration, teaching and research activities and services facilities, and assigned faculties and technicians. The Laboratory has its goals and people with different qualifications and skills work to match them.

The research goals are the main link in the Laboratory activities; another aspect are the knowledge transfer to the education and the service projects like continuous training, undergraduate and graduate programs offered by the Laboratory and the university. The integration with the basic functions of the university: research, education and services is very strong and it is one of the most important features of this structure.

It will be shown how this type of organizational cell works integrated with the community and the university assuring the perfect implementation of the basic university purposes. Another feature will be pointed out as a mechanism for university, research centers and community integration.

PRESENTATION AND HISTORIC

The Automation and Systems Laboratory of the Pontifical Catholic University of Parana – LAS/PUC-PR – started their activities on the second semester of 1996, with the constitution of a Research Group at the University in the Automation and Systems area.

COMPOSITION AND ORGANIZATIONAL STRUCTURE INSERTION

The LAS is composed by five laboratory rooms and an administrative and documentation room. The laboratories are hierarchically joined to the Electrical and Mechanical Departments of PUC-PR. The structure is represented in figure "1".

The laboratory rooms and their acronyms are:

- LAI – Integrated Automation Laboratory;
- LIC – Instrumentation and Controls Laboratory;
- LAM – Manufacturing Automation Laboratory;
- LIM – Electric Installations and Machines;
- LHP – Hydraulics and Pneumatics Laboratory.

The infrastructure described shows what are the competence looked for and the diversity degrees of knowledge and areas, which, imply also in a human resource diversity, involving professionals of electrical, mechanics, chemistry, industrial and computation engineerings and informatics and industrial management in a brief survey.

The LAS is formally subordinated to the Electrical Department because there are some institutional rules to be followed in the university statute and the department is subordinated to a Center - and in this case, Exact Sciences and Technological Center – CCET.

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In the real operation the LAS has some autonomy like a department, or more, in the management of its projects, which is facilitated or grown by the integration and diversity of the laboratories and human resources from different departments. The decision process of approbation and financing the projects are in the department level's, which will be explained later.

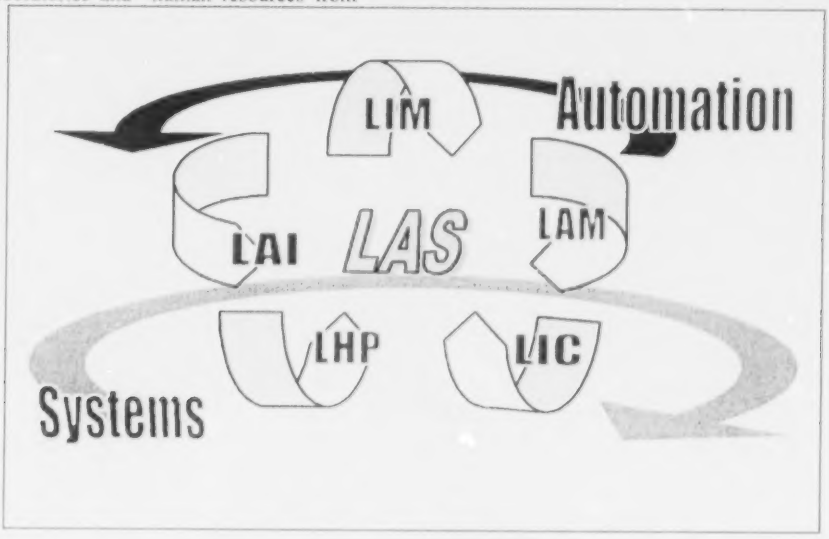

Figure 1 – LAS Structure

OBJECTIVES

The Automation and Systems Laboratory has a main goal to generate knowledge and competencies in the Automation and Systems area, viewing this subject in a large scope. Scientific subjects, technological subjects and organization subjects are dealt in research lines and projects.

The specific objectives are:

- Graduate and undergraduate education in the Automation and Systems area;
- Scientific and technological research;
- University extension by short courses and training (continuous education);
- Consulting activities.

ACTUATION AREAS

The main goal establishes that the System and Automation is the main area of LAS and according with this some research lines were structured as follows.

- *APPLIED CONTROL:* the applied control group deals with technological questions in control engineering problems, in the level of project and application of automation solutions. Subjects like electronic instrumentation, automation and control of continuos and discrete systems and manufacturing are the main activities developed in products like supervisory systems, virtual instrumentation and plc's networks.

- *INDUSTRIAL ACTUATORS:* the industrial actuators group deals with electric, hydraulics and pneumatics actuators, in questions like project, specification and control. The project's profile is to develop an integrated vision in automation context.

- *THEORY OF CONTROL:* the main goal of the group is to found control and automation applications of LAS.

- *TECHNOLOGY AND SYSTEMS INTEGRATION:* the technology and systems integration systems deal with the problem of integrating two main areas, **Automation and Systems** and **Industrial Engineering** (PUC started a new undergraduate in Industrial Engineering in 1998). Subjects like flexibility and integration, innovation management,

knowledge management, job organization and other aspects composes the project's profile.

HUMAN RESOURCES

The LAS is formed by a group of PhD professors and MSc professors from the main centers of Brazil and foregoing countries like Germany and France. The MSc professors are in the university human resource improvement program and will take their PhD's in the next few years. The human resources improvement program also establishes that will be joined to the group ten PhD's in the next three years, since 1998, in the main research lines.

There were also associated members instead of permanent members and trainees (last year undergraduate students) and scholarship students working in several projects.

The most relevant feature is the diversity of the human resources, as mentioned before, which gives to the laboratory o powerful potential to have successful projects. This diversity could be seen as a problem but this characteristic is a internal strength and the organization project is based in this singular feature as will be shown in the next section.

ORGANIZATIONAL STRUCTURE PROPOSAL

Any organization could be seen as a system and this will be the foundation to explain the proposal. The university is a complex system and their subsystems are functionally structured as any organization, but one of the main operational characteristic is that their main purposes are dealt of as projects in a matrix, vertically could be seen the departments and horizontally the courses and research projects (figure "2" explain better this behavior).

The proposal also works in a matrix but the departments are substituted by laboratories, nucleus or any thematic organization cell, the basic idea is to change the main goal of functional cell giving a large scope and flexibility to change their objectives along the time which couldn't happen with the departments.

Morphogenesis is a characteristic of an organization as an open system and this will be preserved in this model. It could be asked if it is only a change from department to laboratory but the orientation is different and in the new cell one of the main operational characteristic is flexibility to change its goals and it could be extinguished or jointed to another group.

A powerful feature is that the human resources have different skills and formations, which is needed to work in a multi-subject project.

The reason for the basic orientation of the LAS to be research is based on a fundamental commitment with the human society, that is to develop and improve the frontiers of the human knowledge. Seeing the university as an inductive agent in the economic and social development, so the research must be one of the most important element in the university process. The others functions will be supported by the university research and will operate as diffusion processes like undergraduate and graduate courses, consulting services and extension projects.

The thematic units like nucleus and laboratories also works oriented by projects as it could be seen in figure "3" and also in the vertical lines will be connected with another projects like graduated and undergraduate programs.

The nature of the projects dealt is in the scope of the basic university purposes: research, education and extension as it will shown in the next section.

The teleology feature will be present when it is shown how the cells plan, manage, assess and do their jobs as a self organized unit. The guidelines of the projects will be the university policies and the function of the centers and other high level units will be formulate and coordinate the policies.

Another way to evaluate this framework is that the refresh of the education process will be fed continuously by the research process and the knowledge transfer will be done by the major actors themselves. The extension process will also be guided by the research process and the community will be in contact with the recent developments also in a continuous way.

SOME RESULTS ALREADY OBTAINED

The great synergy generated by the interaction and integration of different visions in a short time conduct to a rich portfolio of activities. These activities will be described bellow.

CONTROL AND AUTOMATION ENGINEERING UNDERGRADUATE COURSE:

The undergraduate course of Control and Automation Engineering is a qualification with origins in the areas of mechanics and electric engineering and started as an official professional course in 1994 when the first course was recognized. The first university to offer this kind of course was the Federal University of Santa Catarina in 1990, after that several universities offered similar courses. In 1998 the State University of Campinas – UNICAMP - also started a course in this area and its course was one of the most demanded, the fifth one.

The Pontifical Catholic University of Parana started this course in 1998, and one of the most interesting

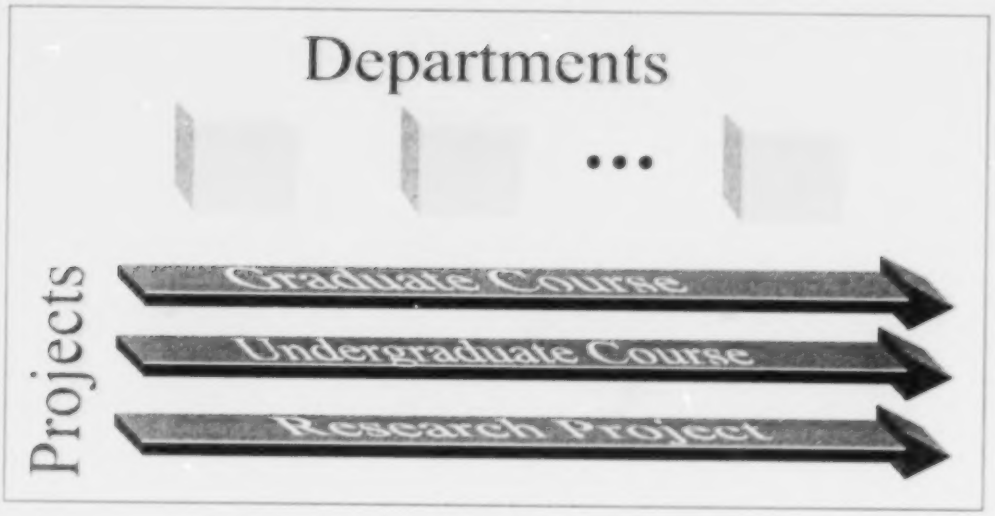

Figure 2 – Project and Department Matrix

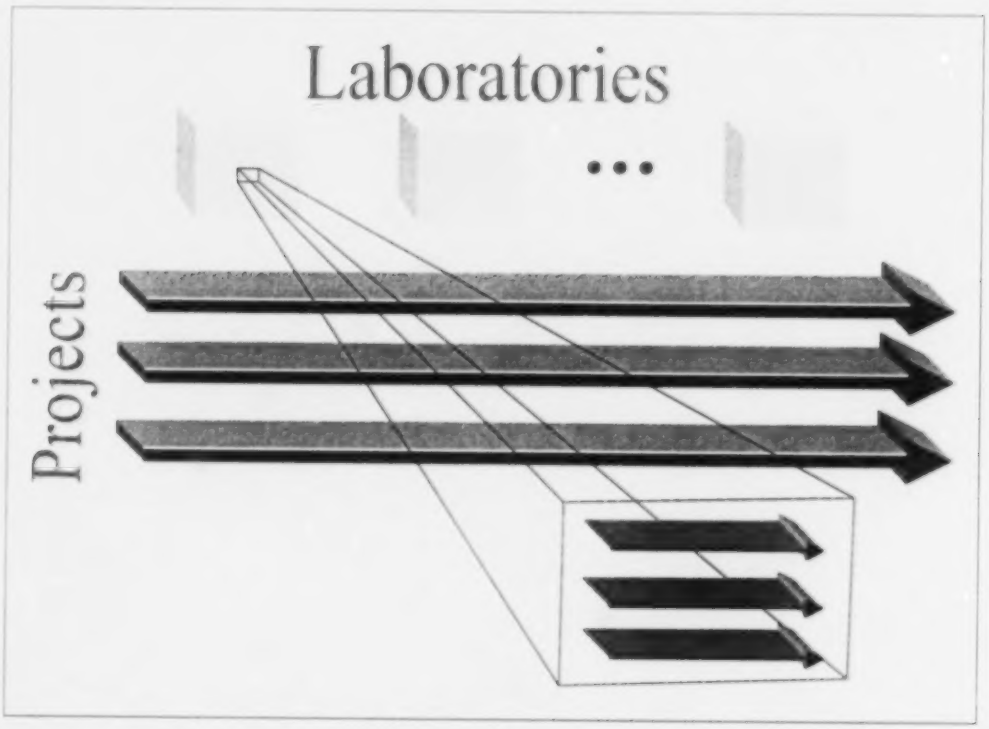

Figure 3 – Project and Laboratories Matrix

characteristics is the balance of the areas like mechanics, electric, informatics and industrial engineering in the program. The balance will lead the program to a generic professional in the area of Automation and Systems.

GRADUATE COURSE (SPECIALIZATION) IN PROCESS CONTROL:

In 1998 will be offered a graduate course in the degree of specialization in the field of Process Control, identified of a demanded area in the state of Parana.

A singular point is that course is supported by ISA – International Society for Measurement and Control – which, resulted by a closely relationship between professors and students of PUC-PR and ISA, is now founding by an institutional cooperation program. To design the specialization program, the professionals of PUC-PR and ISA worked together and will also works in the implementation. This feature will give to the students a very closely reality from the industries shop floor and the recent academic and technological developments.

CONTROL AND AUTOMATION MSC COURSE:

The electric department and LAS are preparing a MSc program in the Automation and System area and the program will probably start in 1999.

INDUSTRIAL ENGINEERING WORK GROUP OF PARANA – GTEPP:

The LAS is also hard involved in a work group, which is composed by the Brazilian Productivity and Quality Institute – IBQB/PR, PUC-PR, Federal University of Parana – UFPR, Federal Center of Technological Education of Parana – CEFET/PR and an Industry Service of Training - SENAI/PR. This group has the main goal to implant and develop the industrial engineering in Parana.

MAIN PROJECTS:

- IDENTIFICATION - CACSD
  It is being developed a computer assisted system to model systems and test controls strategies .

- ELEVATOR
  This project goals are to develop electric machines electronic controls and artificial intelligence strategies to higher control levels.

- AGV
  Automatic control strategies of spatial coordinate is being developed in this project. Another feature which will be explored is the integration of this system in manufacturing system.

CONCLUSIONS

The new organizational project is implementing in the informal system and by the evolution of the university concepts it is believed that it could be implemented in the formal project, looking to its powerful features to keep the university main goals.

The growing of the cells could be supported by an institute or the laboratories could diversify in another groups and thematic cells, the best way to grow is a question to be hard studied.

BIBLIOGRAPHY REFERENCES

1) LAS/PUC-PR. **Proposta do Sistema de Laboratórios na Área de Automação e Sistemas**. PUC-PR 1996.
2) LAS/PUC-PR. **Projeto de Implantação do Curso de Engenharia de Controle e Automação**. PUC-PR 1997.
3) Departamento de Engenharia Elétrica - UFMG **Proposta de Reforma Curricular.** UFMG, 1993
4) LIMA, E.P.; COSTA, S.E.G. ***Curriculum* Evaluation and *Curriculum* Reestructuration to Answer a Technological Society**. 6º Seminário Latinoamericano de Gestión Tecnológica – ALTEC'95, pp. 433-441, vol. 3, Universidad de Concepción, Concepción, Chile, 1995.
5) VENDRAMETO, Oduvaldo. **Bases de Conhecimento para a Automação de Manufatura.** São Paulo, 1994. Tese (Doutorado em Engenharia) - Departamento Engenharia Produção, Escola Politécnica, Universidade São Paulo.
6) COSTA, Luis Sergio Salles; CAULLIRAUX, Heitor M. (Orgs.). **Manufatura integrada por computador:** sistemas integrados de produção: estratégia, organização, tecnologia e recursos humanos. Rio de Janeiro : Campus, 1995.
7) PEACOCK,N. **Communication Between R&D and its Customers:** A Study of BT Laboratories. IEEE Engineering Management Review. pp 62-68, fall 1995.
8) LAAT, P. B. **Matrix Management of Projects and Power Struggles:** A Case Study of an R&D Laboratory. IEEE Engineering Management Review. pp 28-44, winter 1995.
9) BADAWY, M.K. **Educating Technologists in Management of Technology**. IEEE Engineering Management Review. pp 74-81, fall 1995.

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